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ABSTRACT

Lockdowns and the US Unemployment Crisis*

We analyse the short-term impact of social distancing measures on the US labour market, using a panel threshold model with high frequency (weekly) data on unemployment across US states. We find that changes in the restrictiveness of mandated social distancing, as measured by the Oxford Stringency Index, exert a strong immediate impact on initial unemployment. The unemployment rate is not immediate affected but follows within a very short time (two to four weeks). We also document a substantial asymmetry between tightening and easing: the impact of tightening restrictions is twice as large as that of easing them. The state of the endemic, proxied either by cases or fatalities, constitutes a marginal factor.

JEL Classification: E00, I18, O11

Keywords: Corona pandemic, lockdown and unemployment, policy response, COVID-19

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1 Introduction

The Covid-19 pandemic has led to unprecedented economic decline. Since February 2020, policymakers around the globe have introduced several emergency measures such as social distancing and the wearing of masks, restrictions to mobility and travel and shutting down large parts of the economy, including firms, workplaces and schools. The aim to slow down the spread of the virus (flatten the curve) led to the harsh restrictions (lockdown). During the summer of 2020, many restrictions were lifted or relaxed, only to be reinstated when infections surged again during the autumn and winter. However, the lockdown has been associated with a deep economic recession. Following Barro et al. (2020), the losses in output and consumption attributed to the current virus exceed those of the Spanish flu, even under conservative assumptions.

The key question for policymakers is how to manage the trade-off between the spread of the virus and the severity of the lockdown measures. Dealing with this trade-off is a major challenge under pandemic conditions (Eichenbaum et al., 2020).

The pandemic shifted both the supply and demand curve in the economy. On the supply side, infections and lockdowns worsened labour supply and productivity. On the demand side, layoffs and income losses (because of morbidity, quarantines, and unemployment) lowered household consumption and firms' investment. For example, more than one half of participants surveyed reported substantial income and wealth losses. Large drops in consumption, especially in travel and clothing, are also involved (Coibion et al., 2020). The high uncertainty with respect to the path, duration and impact of the pandemic might create downward spirals that dampen business and consumer confidence, with further job losses due to the anticipation of lower future demand. Higher credit default and non-performing loans might contribute to tighter lending standards. Guerrieri et al. (2020) argue that supply shocks associated with the Covid-19 pandemic are amplified by changes in aggregate demand, especially shutdowns, layoffs and the exit of firms.

The appropriate design of policies is critical, as massive losses can be involved. However, empirical evidence on the impact of policies is rather scarce. Several studies have discussed the impact of non-pharmaceutical interventions (NPI) on the evolution of the pandemic, the latter measured by the growth rate of infections in OECD member states (Pozo et al., 2020) or the decline in the virus reproduction rates (Brauner et al., 2020). The interventions are found to be successful in flattening the infection curve. Hsiang et al. (2020) argue that the interventions dampened the contagion, to the order of 61 million Covid-19 cases in six major countries (China, South Korea, Italy, Iran, France, and the US).

We provide new evidence on the short run impact of social distancing measures and the state of the endemic on the labour market, using high frequency labour market data from the US.

The next section provides a summary of existing studies of the economic impact of social distancing. Section 3 presents the broad trends of the US labour market during the 'great lockdown'. Section 4 explains the index of restrictiveness used and section 5 presents the main results from our panel estimates allowing for asymmetric effects, using data for US states close to 40 weekly data observations per state. Section 6 concludes.

2. Studies of the economic impact of social distancing

A large number of studies has already investigated the impact of the corona lockdown on the economy, although mostly from a model-specific angle concentrating on the early phase of the pandemic.

Bodenstein et al. (2020) stress that the absence of social distancing may amplify the costs over longer time intervals. To lower the costs in economic terms, social distancing should be skewed towards non-essential industries and professions that can be performed from home. Due to input-output linkages, however, even non-targeted industries can be affected. According to Getachev (2020), voluntary distancing is very important for both flattening the infection curve and limiting damage to the economy over the course of the endemic. Laeven (2020) emphasises that producers of intermediates tend to be more affected by the crisis if they sell le their output to industrial sectors restricted by social distancing.

Based on costly disasters from the past, Ludvigson et al. (2020) estimate the costs of the pandemic for the US. While past disasters were mostly locally concentrated and rather short-lived, the Covid-19 shock is modelled as a sequence of large disasters in a VAR environment. Even under a conservative scenario, the pandemic will lead to cumulative losses in industrial production of 20% and in employment in the services sector of 40%, i.e. more than 55 million jobs are expected to be lost over the next 12 months. Massive reallocations of labour are inevitably involved.

Chudik et al. (2020) specify a threshold global VAR model to quantify the potentially nonlinear macroeconomic effects of Covid-19. The relationship between output growth and uncertainty, proxied by excess volatility, is subject to threshold effects for both advanced and emerging countries. The Covid-19 shock is identified by the IMF forecast revisions of GDP growth. Results suggest that the pandemic will cause a long-lasting decline in global output, although the effects tend to be unequal in different regions. While Asian countries are less affected, and boosted by the Chinese catch-up, the impacts are greater in the West. Due to strong interlinkages through trade flows, the findings call for a coordinated multi-country policy response to mitigate the effects of the pandemic.

With respect to the labour market, the fact that the pandemic has exacerbated pre-existing inequalities has received most attention. Although employment losses have been widespread, they are substantially larger in lower-paying occupations and industries. Individuals from disadvantaged groups, i.e. Hispanics, younger workers, those with lower levels of education and women have suffered larger job losses and decreases in hiring rates (Cortes and Forsythe, 2020). This indicates that the economic burden of the corona crisis will mostly affect those people who are already in the most vulnerable financial situation (Gascon, 2020). Job losses tend to be less pronounced for employees who can work remotely (Montenovo et al., 2020). By looking at high frequency state-level data, Baek et al. (2020) argue that orders to people to stay at home unless their work is deemed essential accounted for a substantial, but minority share of the rise in unemployment claims.

Pagano et al. (2020) and Capelle-Blancard and Desroziers (2020) examine the effects of the pandemic on the US stock market and highlight its differential impact on various sectors. Baker et al. (2020) show that uncertainty proxied by stock market volatility, newspaper-based uncertainty and subjective uncertainty in busines expectation surveys rose sharply as the pandemic worsened.

Kok (2020) reports a negative relationship between GDP growth and stringency policy measures in a panel of 106 developed and developing countries. As GDP information is available only quarterly and with considerable delay, the time series dimension of such an analysis is very short. (only 2-3 observations per country). The weekly data we use has 12 times more observations per regional unit.

By using real-time information on vacancies and unemployment insurance claims, Forsythe et al. (2020) conclude that the US labour market deteriorated substantially but did so across the board, rather than more so in states with shutdown orders. Therefore, individual state policies and own epidemiological situations have had only a modest effect, see also Rojas et al. (2020).

By contrast, Gupta et al. (2020) found a major role for state social-distancing policies, in addition to the impact of the nationwide shock. There has been a broad retreat across almost all industries, whether they are essential or not. Based on a survey of 5,800 small businesses, Bartik et al (2020) find large employment losses caused by the pandemic.

Most of the existing studies concentrate on the initial phase of the pandemic (first wave) and the ensuing harsh lockdown. Our contribution includes data until the autumn of 2020, a time period during which many restrictions were first loosened and then tightened again. Moreover, we look separately at different measures, allowing us a more precise estimate of which measures had the biggest impact.

Our analysis provides novel evidence on the impact of the lockdown on the US economy, in several respects.

First of all, our sample spans a period of substantial reversal of measures, which were eased during the summer and then re-imposed or tightened again later during the year.

Moreover, we use unemployment data per state to exploit the large differences in the path of the pandemic across US regions.

Finally, we use a high frequency, namely weekly data. Unemployment (claims and rates) seem to be the only real economy data available at this frequency.

A number of very high frequency indicators have been created recently to track output or GDP, even on a daily basis. We do not employ these indicators because we are interested in the size and speed of the impact of social-distancing measures on the labour market (rather than some synthetic measure of overall economic activity).

As 36 weeks and 51 states (including the District of Columbia) are considered, empirical evidence can be based on more than 1,800 observations.

The results point to a strong and quick impact of the lockdown on unemployment. From the variety of measures included in the Oxford index, school closures and stay-at-home regulations are most critical for the economy. The reaction of unemployment to a changing social distancing restrictions is observed with a delay of only about two to four weeks.

In addition, the evolution of unemployment is governed by substantial asymmetries. If the government switches to tighter regulations, the increase in unemployment is higher in absolute value than a decrease after a relaxation. Hence, the decline in unemployment towards the end of the sample cannot be explained in terms of regulation easing.

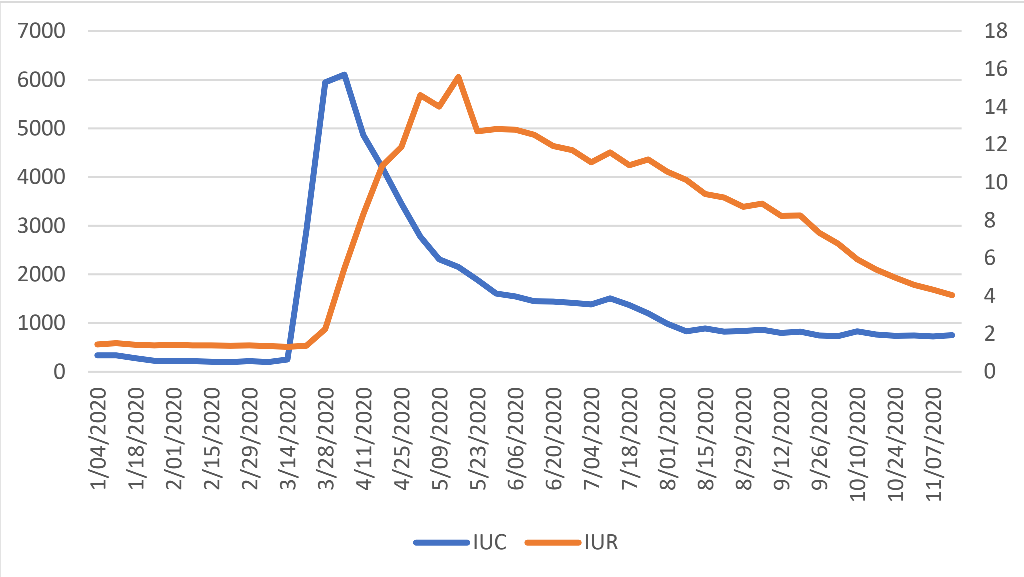
Controls representing the spread of the disease, such as the number of new infections and especially the number of deaths exert some impact, but their role is minor.

3 Trends in US labour markets during the 'great lockdown'

The corona crisis led to a sudden increase in US unemployment. While the insured unemployment rate (IUR) was at record lows just before the outbreak of the crisis, it shot up to almost 16% in April. Since then, unemployment has gradually fallen, but remains at more than double the pre-crisis value.

The IUR is equal to the number of people receiving unemployment insurance as a percentage of the labour force and reported at a weekly frequency. The measured IUR does not comove immediately one to one with the number of unemployment claims filed in the same week. This was particularly the case in the early phases of the crisis when the local unemployment offices were overwhelmed by the huge number of initial claims. Figure 1 illustrates how initial unemployment claims shot up immediately when major measures were taken, followed by a more gradual increase in the (insured) unemployment rate.

Figure 1: Initial unemployment claims (IUC) and the Insured Unemployment Rate (IUR) during the lockdown

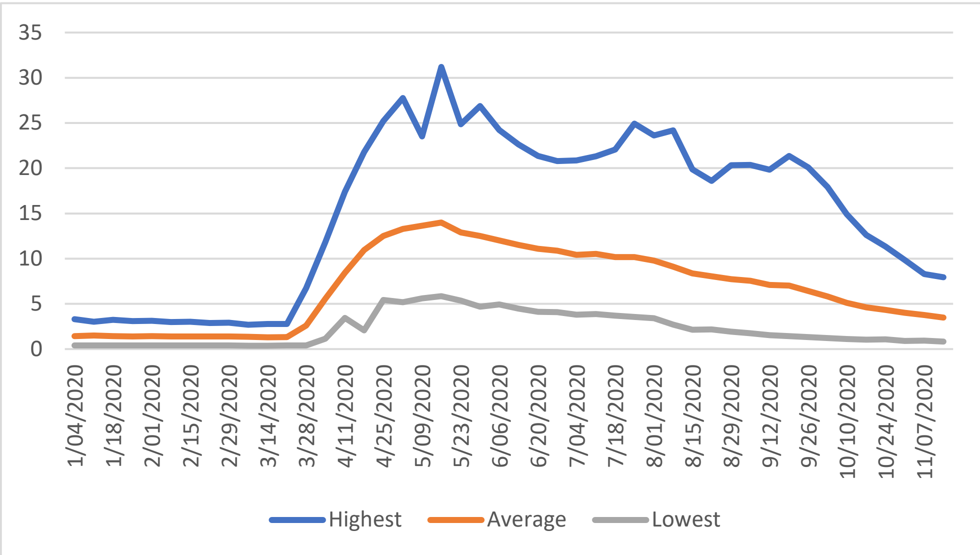


Source: Own elaborations on BLS data. Left hand axis initial unemployment claims (total for US) in thousands. Right hand axis: average insured unemployment rate.

Initial claims (IUC) might thus constitute a useful alternative measure of the state of the labour market (Cajner, 2020). Therefore, initial unemployment claims are also used for a robustness test. In terms of both the IUR and IUC one finds a similar pattern throughout the US: An initial sharp increase, followed by a gradual decline and then another uptick.

Within this overall pattern, the magnitudes differ substantially across states. For instance, the largest increase in the unemployment rate, of almost 30 percentage points, can be observed for Washington, followed by California, Vermont and Florida. In contrast, the labour markets in Utah and Wyoming showed higher resilience, with an increase of around 6 percentage points. States with a high share of employment in the tourism sector like Nevada (25%, gaming industry) and Hawaii (20%) experienced an above-average increase in unemployment but they are not those with the largest employment losses.

Figure 2: Unemployment rates across States: average and dispersion



Source: Own elaborations on BLS data. The line 'Highest' shows the value for the US State with the highest value for that week and similarly for 'Lowest'.

4 Measuring policy restrictions

Several indicators are available to assess the scope of corona-related policies. The government response tracker developed by the Blavatnik School of Government, Oxford University, is the standard measure of policies to arrest the spread of the virus (Hale et al., 2020). It collects daily information on containment and closure practices, which is publicly available from various sources.[2] The components of the Oxford index are rank scaled. Larger values represent a higher level of stringency of the respective policy but quantitative differences between two values cannot be interpreted (Table 1).

Table 1: Components of the Oxford indices

	Min/Max
School closures	0/3
Working place closures	0/3
Cancellation of public events	0/2
Restrictions on gatherings	0/4
Close of public transport	0/2
Stay at home requirements	0/3
Restrictions on internal movements	0/2
International travel controls	0/4

Note: Dimensions of the Oxford stringency index. Min/Max column represents minimum and maximum values. Taken the closures of schools as an example, the values are 0 (no closure), 1 (closing recommended), 2 (only some types of schools, such as high schools) and 3 (all schools).

Table 2: Correlation between Oxford components

	O_1	O_2	O_3	O_4	O_5	O_6	O_7	O_8
O_1	1							
O_2	0.73	1						
O_3	0.75	0.79	1					
O_4	0.73	0.76	0.80	1				
O_5	0.43	0.46	0.42	0.41	1			
O_6	0.62	0.70	0.68	0.65	0.34	1		
O_7	0.49	0.57	0.50	0.53	0.22	0.51	1	
O_8	0.27	0.24	0.22	0.25	0.13	0.25	0.41	1

[2] One alternative to the Oxford indicator is the Google mobility index. It includes several aspects of mobility behaviour, such as visits to parks. For this paper, its value is very limited, as the series are strongly affected by seasonal patterns. Compared to Feb 2020, the Google index shows an increase in mobility at the current edge, probably not because of relaxed restrictions but warmer temperatures after winter.

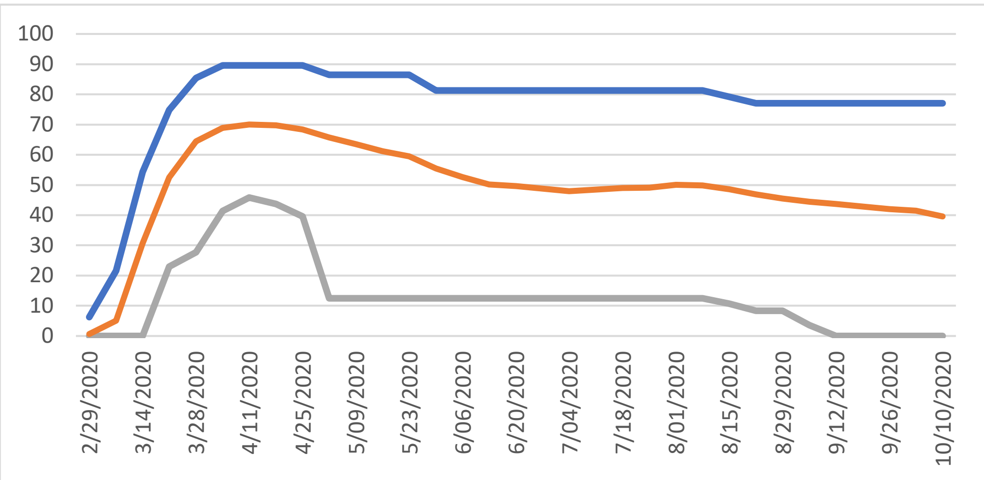
Note: Own calculations based on Hale et al. (2020)

Each individual component is rescaled between 0 and 100. A composite indicator is constructed as the average of the individual components

(1) $OX = \frac{1}{8}\sum_{i=1}^{8} O_i$

Due to their construction the indices vary between 0 and 100. In principle, the individual series in the Oxford indicator can be aggregated in different ways. The advantage of (1) is that the simple average is easy to handle and allows for some averaging out of potential measurement errors on the individual components. With the exception of international travel controls, the correlation between the other components of the Oxford indicator is rather high, where the individual coefficients often exceed 0.6, see Table 2, indicating both substantial co-movement, but also considerable differences. Despite the fact that several restrictions have been gradually lifted, the stringency of the regulations is still at rather high levels. The standard deviation of the average indicator across US states oscillates between 10 and 15 points (compared to an indicator level between 40 and 60 points). There is thus substantial cross-sectional variation that can be exploited in a panel setting.

Figure 3: Oxford stringency index for the US economy, average and dispersion



Note: Average of composite index (orange), minimum and maximum (blue and grey) across the US states.

The US federal government has only limited direct control over the implementation of strategies to combat the crisis. Instead, many decisions are taken at the state, sometimes even at the local level. The overall policy response to the virus is shown in Figure 2, together with the maximum and minimum across the US states. Measures entered into force directly after the outbreak of the crisis and reached a peak in April. Since then, a slight downward trend is observed on average. Stricter policies have been applied in Alaska, Idaho, Kentucky, Maryland and New Mexico, while Arkansas, Iowa, North and South Dakota and Utah had relatively liberal regulations. The least-stringent states, mostly in the Mid-West, had Republican governors (Hale et al., 2020).

5 Panel regressions with asymmetric effects

Panel models with state fixed effects (α) are estimated for the 51 US states (including the District of Columbia) over the pandemic period, i.e., February to mid-October 2020. Unemployment rates and initial claims are available at a weekly frequency from the BLS. Weekly Oxford indices are obtained by averaging daily values over the week. In total 51x36=1836 observations are available, implying a high number of degrees of freedom. To exclude potentially spurious regressions due to trending behaviour in the variables, the equation is expressed in first differences (Δ). As the unemployment reaction might not be immediate, a delay of up to four weeks is allowed. In addition, a threshold is introduced to capture an asymmetric unemployment response to the policy change. The slope parameters can be different, depending on whether policy is tightened or relaxed.

The spread of the virus is widely perceived to have an independent impact on the economy because news of an increase in infections can cause higher uncertainty or caution in certain consumption expenditures (restaurant trips, travel, etc.), leading to an independent fall in labour demand or a rise in unemployment (Baker et al. (2020), Coibon et al. (2020)). In order to account for this separate effect, we introduced as control both the number of infections and deaths (relative to population) at the level of the individual states.

Overall, the insured unemployment rate *u* is explained by the individual components of the Oxford indicator and the composite index aggregate (and later individual components of the) Oxford indicator *O* and corona-related controls for the spread of the disease i.e., resulting in the following equation:

(2) $$\Delta u_{it} = \alpha_{i,j} + \sum_{k=0}^{4} \beta_{j,k} \Delta O_{i,j,t-k} + \sum_{k=0}^{4} \gamma_{j,k} d_{i,j,t-k} \Delta O_{i,j,t-k} \sum_{k=0}^{4} \delta_{l,k} \Delta corona_{i,l,t-k} + \varepsilon_{i,j,t}$$

The indices *i* and *j* denote the individual state and the number of the Oxford indicator (i=1...51; j=1...8 and 9 for the composite index), *t* is time, *k* the delay and ϵ the error term. The threshold is implemented through a binary variable *d*. It is equal to 1 if a policy becomes tighter and 0 otherwise. Hence, the impact is equal to $\beta_{jk}+\gamma_{jk}$ if the policy *j* became stricter *k* periods ago. In case of no change or a policy relaxation, the coefficient is β_{jk}. Corona controls (*l*=1,2) refer to the number of infections and deaths associated with the pandemic. The results are shown in Table 3. To improve the readability of the results, only significant coefficients are shown. The starting point of the model evaluation is an over-parameterised structure with many insignificant variables, for instance due to multicollinearity. At each round of the subsequent iteration process, the least significant regressor is removed. The final specification includes only explanatories with *t*-values larger than 2.

Exactly the same equation is estimated using the same procedure with initial unemployment claims as the dependent variable. The two panels of Table 3 contain the results:

Table 3: Impact of NPIs on the labour market: Composite Oxford indicator

Panel a: Impact on insured unemployment rate

$$\Delta u_{it} = \underset{(0.004)}{-0.211} + \underset{(0.005)}{0.013} \Delta O_{t-1} + \underset{(0.006)}{0.032} \Delta O_{t-2} + \underset{(0.007)}{0.055} d_{t-3} \Delta O_{t-3} + \underset{(0.006)}{0.065} d_{t-4} \Delta O_{t-4}$$
$$+ \underset{(0.005)}{0.013} \Delta dea_t - \underset{(0.010)}{0.027} \Delta dea_{t-1} + \underset{(0.010)}{0.030} \Delta dea_{t-2} - \underset{(0.005)}{0.015} \Delta dea_{t-3}$$
$$R2 = 0.264, \quad SER = 1.378$$

Panel b: Impact on initial unemployment claims

$$\Delta iuc_{it} = \underset{(0.011)}{-0.062} + \underset{(0.002)}{0.015} d_t \Delta O_t + \underset{(0.002)}{0.056} d_{1,t-1} \Delta O_{1,t-1} - \underset{(0.002)}{0.020} d_{1,t-2} \Delta O_{1,t-2}$$
$$\underset{(0.001)}{-0.005} d_{1,t-4} \Delta O_{1,t-4} + \underset{(0.00005)}{0.0002} \Delta\, inf - \underset{(0.00005)}{0.0002} \Delta\, inf_{t-1}$$
$$R2 = 0.527, \quad SER = 0.352$$

Note: Panel model with fixed effects for the 51 US states (including District of Columbia), weekly data from Feb 22 to Oct 10. IUC=Initial unemployment claims (logs). Standard errors in parentheses below regression coefficients. The constant is the average of state level fixed effects. *O* denotes the specific policy covered by the Oxford index, *d* is equal to 1 if a policy is tightened and 0 otherwise, *inf* is the number of new infections and *dea* the number of deaths. *R*2 adjusted coefficient of determination and *SER* the standard error of regression.

The results point to a clear impact of the lockdown on the course of unemployment, which is rapid and asymmetric.

In the case of the unemployment rate (panel a of table 3) the impact of a change in the Oxford restrictiveness indicator can be observed already after one week. If the policy is tightened (i.e. when the dummy d=1) impact continues until lag 4. The sum of the point estimates not involving a tightening is equal to 0.045, which would imply that a change in the aggregate Oxford index of one standard deviation (20 points) should be followed by a change in the unemployment rate of about 0.9 percentage point. However, the sum of the coefficients on tightening is equal to 0.11, implying that a tightening of the same amount leads to an increase in unemployment which is more than twice as large (2.2 percentage points of an increase in the Oxford Stringency Index of one standard deviation. If one considers the initial jump from zero to 70 (the average degree of restrictiveness in March) the equation could explain an increase of close to 8 points (7.7 to be precise) which is not far from the increase in the average unemployment rate recorded in Spring of 2020.

The results with initial unemployment claims as the dependent variable (panel b of table 3) show an immediate impact of the restrictions and a complete asymmetry in the sense that one finds significant coefficients only for tightening, not for a loosening of restrictions. The point estimates that the very strong immediate response is followed with one lag by a further increase in claims, which then is partially reversed during the following few weeks. Increases in infections also have a significant contemporaneous impact on unemployment claims, but it is fully compensated one period later.

The different lag structures found for the unemployment rate and initial claims is due to the more gradual increase in the unemployment rate already documented in Figure 1. This also explains why infections seem to matter more for initial claims and deaths, which are a lagging indicator) for the unemployment rate. A further difference between the results for the unemployment rate and initial claims is that explanatory power is twice as high for the latter.

The impact of controls such as the number of new infections and the number of deaths has some impact, but any effect dissipates quickly as the sum of the coefficients over all significant lags is zero.

Furthermore, we also estimated the same equation separately for each Oxford component listed in Table 1. The results are reported in table 4 in the annex. This strategy can provide some evidence on the appropriate design of policies from an economic point of view. Table 4 in the annex shows that school closures and stay-at-home regulations are most critical for the economy. In addition, the results also confirm in all cases that the impact on unemployment is governed by substantial asymmetries. If the government switches to tighter regulations, the increase in unemployment is higher in absolute value than a decrease after a relaxation.

These results for individual social distancing restrictions also confirm that the state of the pandemic has only a marginal impact, whether one adds as controls the number of new infections or the number of deaths. The short time lags are also confirmed. As a rule, the reaction of unemployment to a changing economic environment is observed with a delay of about two to four weeks.

6 Conclusions

The Covid-19 pandemic led to an unprecedented recession and spike in unemployment as policy makers had to resort to lockdowns to limit the spread of the disease.

This paper provides evidence on the impact of the lockdowns on labour markets in the US. We document considerable heterogeneity among individual states, both in terms of the labour market performance and the time path of the restrictions imposed.

We used panel threshold models specified for US states and based on weekly data. Two labour market indicators are used, namely the insured unemployment rate (IUR) and initial jobless claims (IJC). The details policy responses to the pandemic are proxied by the different components of the Oxford stringency index. Again, these individual indicators (e.g. school closures, prohibitions on mass gatherings, etc.) shows considerable variation across the US.

We find an impact of the policy measures on the labour market, which is strong, rapid and asymmetric.

The impact is rapid: the unemployment rate increases within 2-4 weeks of policy measures being taken and unemployment claims respond almost immediately.

The impact is asymmetric: tightening measures has an impact that is about 50% greater than that of easing measures.

The overall 'Oxford Stringency Indicator', an average of eight different policy intervention types, has the strongest impact on labour markets. Applying the same methodology using its individual components show that the results are very robust, and that school closures and stay-at-home regulations are the most critical for the labour market.

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Table 4: Impact of different NPIs on the labour market

<u>Insured unemployment rate</u>

School closures

$$\Delta u_{it} = -\underset{(0.038)}{0.135} + \underset{(0.003)}{0.021}\Delta O_{1,t-2} + \underset{(0.003)}{0.033}d_{1,t-3}\Delta O_{1,t-3} + \underset{(0.003)}{0.037}d_{1,t-4}\Delta O_{1,t-4}$$

$$+\underset{(0.005)}{0.014}\Delta dea - \underset{(0.010)}{0.031}\Delta dea_{t-1} + \underset{(0.010)}{0.036}\Delta dea_{t-2} - \underset{(0.005)}{0.018}\Delta dea_{t-3}$$

$R2 = 0.221, \quad SER = 1.417$

Working place closures

$$\Delta u_{it} = -\underset{(0.036)}{0.205} + \underset{(0.003)}{0.008}\Delta O_{2,t} + \underset{(0.004)}{0.036}d_{2,t-2}\Delta O_{1,t-2} + \underset{(0.004)}{0.025}d_{2,t-3}\Delta O_{2,t-3}$$

$$+\underset{(0.004)}{0.045}d_{2,t-4}\Delta O_{2,t-4}$$

$R2 = 0.222, \quad SER = 1.418$

Cancellation of public events

$$\Delta u_{it} = -\underset{(0.039)}{0.181} + \underset{(0.002)}{0.005}\Delta O_{3,t-1} + \underset{(0.003)}{0.016}d_{3,t-2}\Delta O_{3,t-2} + \underset{(0.003)}{0.027}d_{3,t-3}\Delta O_{3,t-3}$$

$$+\underset{(0.003)}{0.040}d_{3,t-4}\Delta O_{3,t-4} + \underset{(0.005)}{0.014}\Delta dea - \underset{(0.010)}{0.025}\Delta dea_{t-1} + \underset{(0.010)}{0.034}\Delta dea_{t-2} - \underset{(0.005)}{0.020}\Delta dea_{t-3}$$

$R2 = 0.198, \quad SER = 1.438$

Restrictions on gatherings

$$\Delta u_{it} = -\underset{(0.039)}{0.206} + \underset{(0.003)}{0.007}\Delta O_{4,t-1} + \underset{(0.003)}{0.025}d_{4,t-2}\Delta O_{4,t-2} + \underset{(0.003)}{0.028}d_{4,t-3}\Delta O_{4,t-3}$$

$$+\underset{(0.003)}{0.036}d_{4,t-4}\Delta O_{4,t-4} + \underset{(0.005)}{0.017}\Delta dea_t - \underset{(0.010)}{0.026}\Delta dea_{t-1} + \underset{(0.010)}{0.031}\Delta dea_{t-2} - \underset{(0.005)}{0.018}\Delta dea_{t-3}$$

$R2 = 0.214, \quad SER = 1.424$

Close of public transport

$$\Delta u_{it} = -\underset{(0.041)}{0.073} + \underset{(0.004)}{0.011}\Delta O_{5,t} + \underset{(0.006)}{0.029}d_{5,t-1}\Delta O_{5,t-1} + \underset{(0.006)}{0.032}d_{5,t-2}\Delta O_{5,t-2}$$

$$+ \underset{(0.006)}{0.042}d_{5,t-3}\Delta O_{5,t-3}$$

$$+\underset{(0.006)}{0.030}d_{5,t-4}\Delta O_{5,t-4} + \underset{(0.006)}{0.013}\Delta dea_t - \underset{(0.011)}{0.027}\Delta dea_{t-1} + \underset{(0.011)}{0.032}\Delta dea_{t-2} - \underset{(0.006)}{0.018}\Delta dea_{t-3}$$

$R2 = 0.106, \quad SER = 1.518$

Stay-at-home requirements

$$\Delta u_{it} = \underset{(0.039)}{-0.208} + \underset{(0.006)}{0.020}\Delta O_{6,t-2} + \underset{(0.005)}{0.039} d_{6,t-1}\Delta O_{6,t-1} + \underset{(0.008)}{0.021} d_{6,t-2}\Delta O_{6,t-2} + \underset{(0.005)}{0.040} d_{6,t-3}\Delta O_{6,t-3}$$

$$+\underset{(0.005)}{0.052} d_{6,t-4}\Delta O_{6,t-4} + \underset{(0.005)}{0.017}\Delta dea_t - \underset{(0.010)}{0.026}\Delta dea_{t-1} + \underset{(0.010)}{0.030}\Delta dea_{t-2} - \underset{(0.005)}{0.017}\Delta dea_{t-3}$$

$R2 = 0.239, \quad SER = 1.401$

Restrictions on internal movement

$$\Delta u_{it} = \underset{(0.041)}{-0.125} + \underset{(0.003)}{0.010}\Delta O_{7,t} + \underset{(0.004)}{0.019} d_{7,t-1}\Delta O_{7,t-1} + \underset{(0.004)}{0.028} d_{7,t-2}\Delta O_{7,t-2} + \underset{(0.004)}{0.026} d_{6,t-3}\Delta O_{7,t-3}$$

$$+\underset{(0.003)}{0.024} d_{7,t-4}\Delta O_{7,t-4} + \underset{(0.006)}{0.021}\Delta dea_t - \underset{(0.011)}{0.032}\Delta dea_{t-1} + \underset{(0.011)}{0.026}\Delta dea_{t-2} - \underset{(0.006)}{0.016}\Delta dea_{t-3}$$

$R2 = 0.133, \quad SER = 1.495$

International travel controls

$$\Delta u_{it} = \underset{(0.042)}{0.035} + \underset{(0.010)}{0.036} d_{8,t-1}\Delta O_{8,t-1} + \underset{(0.010)}{0.043} d_{8,t-3}\Delta O_{8,t-3} + \underset{(0.010)}{0.025} d_{8,t-4}\Delta O_{8,t-4}$$

$$+\underset{(0.006)}{0.027}\Delta dea - \underset{(0.011)}{0.038}\Delta dea_{t-1} + \underset{(0.011)}{0.034}\Delta dea_{t-2} - \underset{(0.006)}{0.023}\Delta dea_{t-3}$$

$R2 = 0.019, \quad SER = 1.591$

<u>Initial unemployment claims</u>

School closures

$$\Delta iuc_{it} = \underset{(0.010)}{-0.067} - \underset{(0.001)}{0.003}\Delta O_{1,t-4} + \underset{(0.001)}{0.009} d_{1,t}\Delta O_{1,t} + \underset{(0.001)}{0.029} d_{1,t-1}\Delta O_{1,t-1}$$

$$+\underset{(0.00005)}{0.0001}\Delta\, inf - \underset{(0.00005)}{0.0001}\Delta\, inf_{t-1}$$

$R2 = 0.572, \quad SER = 0.335$

Working place closures

$$\Delta iuc_{it} = \underset{(0.012)}{-0.048} + \underset{(0.001)}{0.015} d_{2,t}\Delta O_{2,t} + \underset{(0.001)}{0.021} d_{2,t-1}\Delta O_{2,t-1} - \underset{(0.001)}{0.003} d_{2,t-3}\Delta O_{2,t-3}$$

$$-\underset{(0.001)}{0.003} d_{2,t-4}\Delta O_{2,t-4} + \underset{(0.00005)}{0.0001}\Delta\, inf_t - \underset{(0.00005)}{0.0001}\Delta\, inf_{t-1}$$

$R2 = 0.380, \quad SER = 0.404$

Cancellation of public events

$$\Delta iuc_{it} = -\underset{(0.012)}{0.058} + \underset{(0.001)}{0.036} d_{3,t}\Delta O_{3,t} + \underset{(0.001)}{0.025} d_{3,t-1}\Delta O_{3,t-1} + \underset{(0.001)}{0.004} d_{3,t-2}\Delta O_{3,t-2}$$
$$-\underset{(0.001)}{0.003} d_{3,t-4}\Delta O_{3,t-4} + \underset{(0.00005)}{0.0003}\Delta\, inf - \underset{(0.00005)}{0.0003}\Delta\, inf_{t-1}$$
$$R2 = 0.443, \quad SER = 0.382$$

Restrictions on gatherings

$$\Delta iuc_{it} = -\underset{(0.012)}{0.053} + \underset{(0.001)}{0.003}\Delta O_{4,t-1} + \underset{(0.001)}{0.013} d_{4,t}\Delta O_{4,t} + \underset{(0.001)}{0.021} d_{4,t-1}\Delta O_{4,t-1}$$
$$-\underset{(0.002)}{0.005} d_{4,t-4}\Delta O_{4,t-4} + \underset{(0.001)}{0.0002}\Delta\, inf_t - \underset{(0.001)}{0.0003}\Delta\, inf_{t-1}$$
$$R2 = 0.408, \quad SER = 0.394$$

Close of public transport

$$\Delta iuc_{it} = \underset{(0.013)}{0.016} + \underset{(0.002)}{0.021} d_{5,t}\Delta O_{5,t} + \underset{(0.002)}{0.012} d_{5,t-1}\Delta O_{5,t-1} - \underset{(0.002)}{0.004} d_{5,t-3}\Delta O_{5,t-3}$$
$$+\underset{(0.00001)}{0.0002}\Delta\, inf_t - \underset{(0.00001)}{0.0003}\Delta\, inf_{t-1}$$
$$R2 = 0.118, \quad SER = 0.474$$

Stay-at-home requirements

$$\Delta iuc_{it} = -\underset{(0.012)}{0.007} + \underset{(0.001)}{0.006}\Delta O_{6,t-1} + \underset{(0.001)}{0.031} d_{6,t}\Delta O_{6,t} - \underset{(0.001)}{0.004} d_{6,t-3}\Delta O_{6,t-3}$$
$$+\underset{(0.00001)}{0.0003}\Delta\, inf_t - \underset{(0.00001)}{0.0003}\Delta\, inf_{t-1}$$
$$R2 = 0.254, \quad SER = 0.436$$

Restrictions on internal movement

$$\Delta iuc_{it} = \underset{(0.014)}{0.027} + \underset{(0.001)}{0.012} d_{7,t}\Delta O_{7,t} + \underset{(0.001)}{0.005} d_{7,t-1}\Delta O_{7,t-1} - \underset{(0.001)}{0.003} d_{7,t-4}\Delta O_{7,t-4}$$
$$+\underset{(0.00001)}{0.0003}\Delta\, inf_t - \underset{(0.00001)}{0.0003}\Delta\, inf_{t-1}$$
$$R2 = 0.085, \quad SER = 0.489$$

International travel controls

$$\Delta iuc_{it} = \underset{(0.014)}{0.060} + \underset{(0.003)}{0.012} d_{8,t-1}\Delta O_{8,t-1} - \underset{(0.003)}{0.008} d_{8,t-4}\Delta O_{8,t-4}$$

$$+\underset{0.00001}{0.0003}\Delta\, inf_t - \underset{(0.00001)}{0.0004}\,\Delta\, inf_{t-1}$$

$$R2 = 0.006, \quad SER = 0.510$$

Note: Panel model with fixed effects for the 51 US states (including District of Columbia), weekly data from Feb 22 to Oct 10. u=Insured unemployment rate, iuc=Initial unemployment claims (logs). Standard errors in parentheses below regression coefficients. The constant is the average of state level fixed effects. *O* denotes the specific policy covered by the Oxford index, *d* is equal to 1 if a policy is tightened and 0 otherwise, *inf* is the number of new infections and *dea* the number of deaths. *R*2 adjusted coefficient of determination and *SER* the standard error of regression.